giving the ratio

$$\frac{A_1}{A_2} = \frac{\sin^3\theta_1 \cos\theta_1}{\cos^3\theta_2 \sin\theta_2} = \tan^2\theta_1, \quad \text{since} \quad \theta_2 = \frac{\pi}{2} - \theta_1.$$

This also might have been gotten by dividing the maximum altitude of the first projectile, $(v^2 \sin^2\theta_1)/2g$, by that of the second projectile, $(v^2 \cos^2\theta_1)/2g$, as the horizontal distance of the two, $(2v^2 \cos\theta \sin\theta)/g$, is the same.

Also note that if $\theta_1 = \theta_2$, we have a maximum horizontal distance. And further, noting the equation, $y = vt \sin\theta - \frac{1}{2}gt^2$, we find the total time $t = (2v \sin\theta)/g$, and $t_1/t_2 = \tan\theta_1$.

Note. This problem was incorrectly listed under Geometry in the November, 1913, issue. It should have been under Mechanics. EDITORS.

Also solved by RICHARD MORRIS, J. L. RILEY, B. L. LIBBY, C. N. SCHMALL, A. M. HARDING, HORACE OLSON, S. W. REAVES, W. C. EELLS, and J. W. CLAWSON.

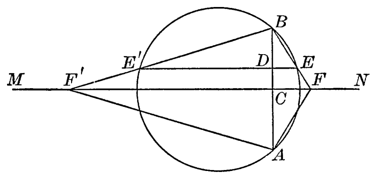
A solution of 424 by J. W. CLAWSON was received too late for publication in the March issue.

426. Proposed by R. D. CARMICHAEL, Indiana University.

On a given chord of a circle as a base construct an isosceles triangle, with vertex outside of the circle, such that its sides shall be divided in a given ratio by their points of intersection with the circle.

SOLUTION BY J. B. SMITH, Hampden-Sidney, Va.

Let AB be the given chord, C its mid-point and MN its perpendicular bisector. Let $m : n$ be the given ratio.



Divide the semi-chord BC in the given ratio. If D be the point of division, erect the perpendicular to AB at D. Let it cut the circle at E, E'; draw BE and produce it to meet MN at F and draw AF. Then AFB is the required triangle. For $AF = BF$ and $BE : EF = BD : DC = m : n$. $BF'A$ is another solution.

Also solved by G. W. HARTWELL, M. E. GRABER, C. HORNUNG, A. M. HARDING, ELMER SCHUYLER, RICHARD MORRIS, KENNETH REYNOLDS, BARNEM LIBBY, J. W. CLAWSON, and EMMA M. GIBSON.

CALCULUS.

341. Proposed by E. B. ESCOTT, University of Michigan.

Find the value for the volume of a barrel in terms of its length l, the bung diameter a and the head diameter b, also an approximate expression when a and b are nearly equal.

I. SOLUTION BY THE PROPOSER.

The simplest curve for the longitudinal cross section of the barrel is probably a parabola. Its equation, since it has its vertex on the y-axis and passes through the points $(-l/2, b/2)$, $(0, a/2)$, $(l/2, b/2)$, is

$$y = \frac{a}{2} - \frac{2(a-b)}{l^2}x^2.$$